

No.

9900374



# THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Pioneer Hi-Bred International, Inc.

Whereas, THERE HAS BEEN PRESENTED TO THE

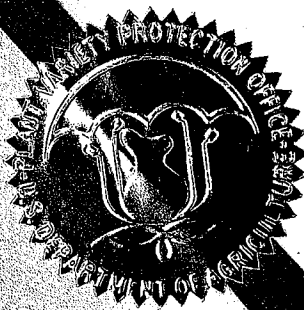
Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE, AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

CORN, FIELD

'PH2E4'



In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this sixth day of November, in the year two thousand one.

Attest:

*Paul M. Johnson*

Commissioner  
Plant Variety Protection Office  
Agricultural Marketing Service

*Freeman*

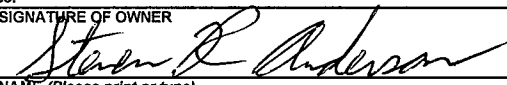
Secretary

U.S. DEPARTMENT OF AGRICULTURE  
AGRICULTURAL MARKETING SERVICE  
SCIENCE AND TECHNOLOGY DIVISION - PLANT VARIETY PROTECTION OFFICE

**APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE**  
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER <b>Pioneer Hi-Bred International, Inc.</b>		2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER		3. VARIETY NAME <b>PH2E4</b>	
4. ADDRESS (Street and No. or RFD No., City, State and Zip Code, and Country) <b>7301 NW 62<sup>nd</sup> Avenue P.O. Box 85 Johnston, IA 50131-0085</b>		5. TELEPHONE (Include area code) <b>515/270-4051</b>		FOR OFFICIAL USE ONLY PVPO NUMBER <b>9900374</b>	
		6. FAX (Include area code) <b>515/253-2125</b>			
7. IF THE OWNERNAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION (corporation, partnership, association, etc.) <b>8. Corporation</b>	8. IF INCORPORATED, GIVE STATE OF INCORPORATION <b>IOWA</b>	9. DATE OF INCORPORATION <b>May 6, 1926</b>		FILING DATE <b>7/30/99</b>	
10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION (FIRST PERSON LISTED WILL RECEIVE ALL PAPERS) <b>Steven R. Anderson Research and Product Development P.O. Box 85 Johnston, IA 50131-0085</b>					
11. TELEPHONE (Include area code) <b>515/270-4051</b>	12. FAX (Include area code) <b>515/253-2125</b>	13. E_MAIL <b>ANDERSONS@PHIBRED.COM</b>		14. CROP KIND NAME (Common name) <b>Corn</b>	
15. GENUS AND SPECIES NAME OF CROP <b>Zea Mays</b>		16. FAMILY NAME (Botanical) <b>Gramineae JRM 3/7/01</b>		17. IS THE VARIETY A FIRST GENERATION HYBRID? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
18. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse) <ul style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> Exhibit A. Origin and Breeding History of the Variety</li> <li>b. <input checked="" type="checkbox"/> Exhibit B. Statement of Distinctness</li> <li>c. <input checked="" type="checkbox"/> Exhibit C. Objective Description of the Variety</li> <li>d. <input checked="" type="checkbox"/> Exhibit D. Additional Description of the Variety (Optional)</li> <li>e. <input checked="" type="checkbox"/> Exhibit E. Statement of the Basis of the Owner's Ownership</li> <li>f. <input checked="" type="checkbox"/> Voucher Sample (2500 viable untreated seeds or, for tuber propagated varieties verification that tissue culture will be deposited and maintained in an approved public repository)</li> <li>g. <input checked="" type="checkbox"/> Filing and Examination Fee (\$2,450), made payable to "Treasurer of the United States" (Mail to Plant Variety Protection Office)</li> </ul>				19. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? See Section 83(a) of the Plant Variety Protection Act <input type="checkbox"/> YES (If "yes", answer items 20 and 21 below) <input checked="" type="checkbox"/> NO (If "no", go to item 22)	
				20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS? <input type="checkbox"/> YES <input type="checkbox"/> NO	
				21. IF "YES" TO ITEM 20, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED? <input type="checkbox"/> FOUNDATION <input type="checkbox"/> REGISTERED <input type="checkbox"/> CERTIFIED	
22. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U.S. OR OTHER COUNTRIES? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO  IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. (Please use space indicated on reverse) <b>United States; Nov. 1, 1998</b>				23. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT (PLANT BREEDER'S RIGHT OR PATENT)? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO  IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. (Please use space indicated on reverse.)	
24. The owner(s) declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.  The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.  Owner(s) is(are) informed that false representation herein can jeopardize protection and results in penalties.					
SIGNATURE OF OWNER		SIGNATURE OF OWNER 			
NAME (Please print or type)		NAME (Please print or type) <b>Steven R. Anderson</b>			
CAPACITY OR TITLE		CAPACITY OR TITLE <b>Senior Research Associate</b>		DATE <b>7-29-99</b>	

## INSTRUCTIONS

GENERAL: To be effectively filed with the Plant Variety protection Office (PVPO), ALL of the following items must be received in the PVPO: (1) Completed application form signed by the owner; (2) completed Exhibits A,B,C,E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety sy lrsdy 2,500 untreated seeds of each line necessary to reproduce the variety, or for tuber reproduced varieties verification that a viable (in the sense that it will reproduce an entire plant) tissue culture will be deposited and maintained in a approved public repository; (4) check drawn on a U.S. bank for \$2,450 (\$300 filing fee and \$2,150 examination fee), payable to "Treasurer of the United States" (See Section 97.6 of the Regulations and Rules of Practice.) Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfilled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 500, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. DO NOT use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of \$300 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

## Plant Variety Protection Office

Telephone: (301)504-5518

FAX: (301)504-5291

Homepage: <http://www.ams.usda.gov/science/pvp.htm>

## ITEM

- 18a. Give: (1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;  
(2) the details of subsequent stages of selection and multiplication;  
(3) evidence of uniformity and stability; and  
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified.
- 18b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:  
(1) identify these varieties and state all differences objectively;  
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and  
(3) submit, if helpful, seed and plant specimens of photographs (prints) of seed and plant comparisons which clearly indicate distinctness.
- 18c. Exhibit C forms are available from the PVPO for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.
- 18d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant disease resistance, etc.
- 18e. Section 52(5) of the Act required applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.
19. If "Yes" is specified (*seed of this variety be sold by variety name only, as a class of certified seed*), the applicant may NOT reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, applicant may change the choice. (See *Regulations and Rules of Practice, Section 7.103*).
22. See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.
23. See Section 5.5 of the Act for instructions on claiming the benefit of an earlier filing date.
- 
22. CONTINUED FROM FRONT (*Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.*)

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23. CONTINUED FROM FRONT (*Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).*)

NOTES; It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. There is no charge for filing a change of address. The fee for filing a change of ownership or assignment or any modification of owner's name is specified in Section 97.175 of the regulations. (See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of Regulations and Rules of Practice.)

To avoid conflict with other variety names in use, the applicant should check the variety names proposed by contacting: Seed Branch, AMS, USDA, Room 213, Building 306, Beltsville Agricultural Research Center--East, Beltsville, MD 20705. Telephone: (301) 504-8089.

Public reporting burden for this collection of information is estimated to average 30 minutes per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Agriculture, Clearance Officer, OIRM, AG Box 7630, Jamie L. Whitten Building, Washington, D.C. 20250. When replying, refer to OMB No. 0581-0055 and form number in your letter. Under the PRA of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

The U.S. Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs). Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202) 720-2791. To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250, or call (202) 720-7327 (voice) or (202) 720-1127 (TDD). USDA is an equal employment opportunity employer.

## Exhibit A. Origin and Breeding History

Pedigree: PHRH1/PHKW3)XA34221X

Pioneer Line PH2E4, Zea mays L., a dent corn inbred, was developed by Pioneer Hi-Bred International, Inc. from the single cross hybrid PHRH1 X PHKW3 (PVP Certificate No. 9500209) using the pedigree method of plant breeding. Varieties PHRH1 and PHKW3 are proprietary inbred lines of Pioneer Hi-Bred International, Inc. Selfing and selection were practiced within the segregating population from the above hybrid for 11 generations using pedigree selection. During line development, crosses were made to inbred testers for the purpose of estimating the line's combining ability. Yield trials were grown at Miami, Missouri as well as other United States Pioneer research locations. After initial testing, additional hybrid combinations have been evaluated and subsequent generations of the line have been grown and hand-pollinated with observations again made for uniformity.

### PHRH1

Variety PHRH1 was derived by pedigree selection from the single cross hybrid PH6W9 X PHR03 (PVP Certificate No. 9100097). Variety PH6W9 was derived by pedigree selection from PH814 X PHG16. The varieties C103, OS420, 38-11, OS426 contributed greatly to the genotype in the derivation of PH814. Variety PHG16 was derived by pedigree selection from PH814 X PHB41. Variety PHB41 was derived by pedigree selection from a triple cross hybrid. Far South Open Pollinated synthetic, OH43, Coker616, I205, IDT, Troyer Reid Open Pollinated, and Minn49 contributed to the genotype in the derivation of PHB41.

Variety PH2E4 has shown uniformity and stability for all traits as described in Exhibit C - "Objective Description of Variety". It has been self-pollinated and ear-rowed 11 generations with careful attention paid to selection criteria and uniformity of plant type to assure genetic homozygosity and phenotypic stability. The line has been increased both by hand and in isolated fields with continued observations for uniformity and stability for a minimum of 5 generations during the final stages of inbred development and seed multiplication. Very high standards for genetic purity have been established morphologically using field observations and electrophoretically using sound lab molecular marker methodology.

No variant traits have been observed or are expected in PH2E4.

The criteria used in the selection of PH2E4 were yield, both per se and in hybrid combinations; late season plant health, grain quality, stalk lodging resistance, and kernel size, especially important in production. Other selection criteria include: ability to germinate in adverse conditions; number of tillers, especially important in production because having numerous tillers increases hybrid production costs spent on detasseling; disease and insect resistance; pollen yield and tassel size.

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**Exhibit A: Developmental history for PH2E4**

<b>Season/Year Pedigree Grown</b>	<b>Inbreeding Level of Pedigree Grown</b>
Summer 1992 PHRH1 and PHKW3 crossed	F0
Winter 1992 PHRH1/PHKW3	F1
Summer 1993 PHRH1/PHKW3)X	F2
Summer 1994-MO PHRH1/PHKW3)XA3	F3
Winter 1994 PHRH1/PHKW3)XA34	F4
Summer 1995-MO PHRH1/PHKW3)XA342	F5
Winter 1995 PHRH1/PHKW3)XA3422	F6
Summer 1996 PHRH1/PHKW3)XA34221	F7
Winter 1996 PHRH1/PHKW3)XA342212	F8
Summer 1997 PHRH1/PHKW3)XA3422127	F9
Winter 1997 PHRH1/PHKW3)XA34221272	F10
Summer 1998 PHRH1/PHKW3)XA342212722	F11

\*PH2E4 was selfed and ear-rowed from F1 through F11 generation.

#Uniformity and stability were established from F7 through F11 generation and beyond when seed supplies were increased.

## Exhibit B. Novelty Statement

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Variety PH2E4 mostly resembles Pioneer Hi-Bred International, Inc. proprietary inbred line PHKW3 (PVP Certificate No. 9500209). The data in Tables 1A and 1B are from paired comparisons collected primarily in Johnston and Ankeny, IA. The data in Table 2 are from paired comparisons at multiple locations grown primarily in the adapted growing area of PH2E4. The traits collectively show measurable differences between the two varieties.

Variety PH2E4 has longer ear length (17.0 vs 13.2 cm) than PHKW3. (Table 1A, 1B) (Figure 1)

Variety PH2E4 has red (14) cob color (Munsell Code = 7.5R56 ) and PHKW3 has white (19) cob color (Munsell Code = 2.5Y9/2). (Figure 1)

Variety PH2E4 reaches 50% pollen shed (GDUSHD) later (1444 GDU's vs 1391 GDU's) than PHKW3 (Table 2).

Variety PH2E4 reaches 50% silking (GDUSLK) later (1480 GDU's vs 1428 GDU's) than PHKW3 (Table 2).

A t-test was used to compare differences between means and the appropriate parameters have been included. Due to the way our historical data has been stored, it is difficult to obtain standard deviations for table 2.

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8/16/01

# Exhibit B Novelty Statement Tables

Table 1A. These data indicate differences between varieties PH2E4 and PHKW3. Data are from Johnston and Ankeny, Iowa at 3 different locations in 1997 and 1998. A t-test was used to compare differences between means. Five plants were measured at each location.

station	year	Trait	variety-1	variety-2	Count	Mean-1	Mean-2	StdDev-1	StdDev-2	Std Error-1	Std Error-2	Mean Diff	DF Pooled	t-Value Pooled	Prob (2-tail) Pooled
AD	1997	ear length (cm)	PH2E4	PHKW3	5	17.2	14.2	0.837	0.837	0.374	0.374	3.0	8	5.67	0.000
JH	1997	ear length (cm)	PH2E4	PHKW3	5	17.4	13.2	0.894	1.643	0.400	0.735	4.2	8	5.02	0.001
AD	1998	ear length (cm)	PH2E4	PHKW3	5	16.8	13.2	0.837	0.837	0.374	0.374	3.6	8	6.80	0.000
IT	1998	ear length (cm)	PH2E4	PHKW3	5	16.8	12.8	0.447	1.304	0.200	0.583	4.0	8	6.49	0.000
JH	1998	ear length (cm)	PH2E4	PHKW3	5	16.8	12.8	1.643	1.304	0.735	0.583	4.0	8	4.26	0.003

Table 1B. Summary data from Johnston and Ankeny, Iowa in 1997 and 1998, and across environments.

year	Trait	variety-1	variety-2	Count	Mean-1	Mean-2	StdDev-1	StdDev-2	Std Error-1	Std Error-2	Mean Diff	DF Pooled	t-Value Pooled	Prob (2-tail) Pooled
1997	ear length (cm)	PH2E4	PHKW3	10	17.3	13.7	0.823	1.337	0.260	0.423	3.6	18	7.25	0.000
1998	ear length (cm)	PH2E4	PHKW3	15	16.8	12.9	1.014	1.100	0.262	0.284	3.9	28	10.01	0.000

Trait	variety-1	variety-2	Count	Mean-1	Mean-2	StdDev-1	StdDev-2	Std Error-1	Std Error-2	Mean Diff	DF Pooled	t-Value Pooled	Prob (2-tail) Pooled
ear length (cm)	PH2E4	PHKW3	25	17.0	13.2	0.957	1.234	0.191	0.247	3.8	48	12.04	0.000

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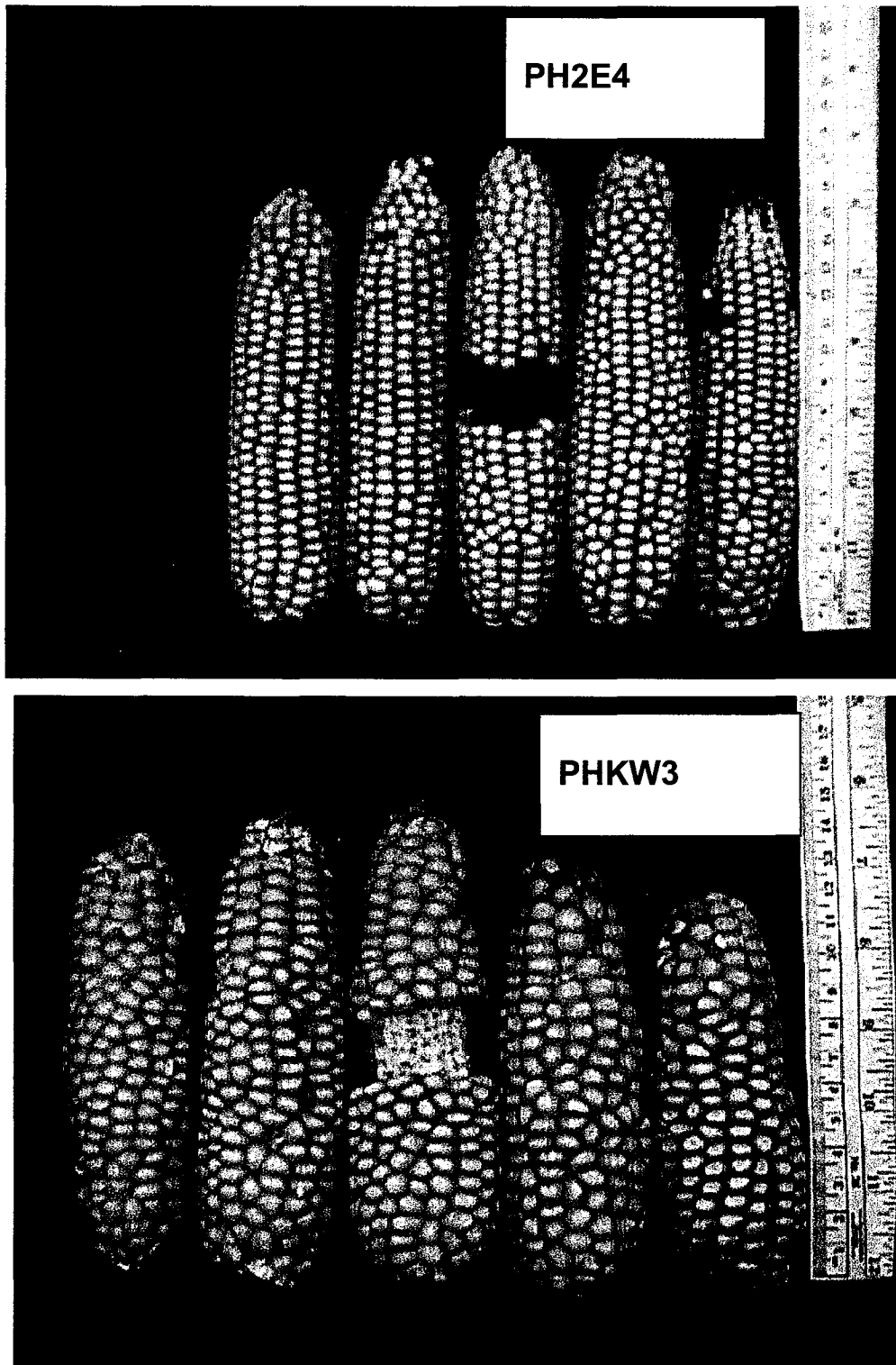
**Exhibit B. Novelty Statement Tables**

**Table 2. These data indicate differences between varieties PH2E4 and PHKW3. Data are from multiple locations and years grown primarily in the adapted growing area.**

**Variety 1 = PH2E4**  
**Variety 2 = PHKW3**

Variety 1	PH2E4		
Variety 2	PHKW3		
		GDU	GDU
	VAR	SHD	SLK
YEAR	#	ABS	ABS
-----	-----	-----	-----
1996	1	1390	1420
	2	1364	1393
	LOCS	6	6
	PROB	0.236	0.273
1997	1	1451	1483
	2	1387	1423
	LOCS	28	28
	PROB	.000#	.000#
1998	1	1449	1489
	2	1402	1440
	LOCS	28	28
	PROB	.000#	.000#
TOTAL SUM	1	1444	1480
	2	1391	1428
	LOCS	62	62
	DIFF	53	52
	PROB	.000#	.000#

Figure 1. Ear pictures of variety PH2E4 and PHKW3.



United States Department of Agriculture, Agricultural Marketing Service  
Science Division, Plant Variety Protection Office  
National Agricultural Library Building, Room 500  
Beltsville, MD 20705

9900374

Objective Description of Variety  
Corn (Zea mays L.)

Name of Applicant (s) <b>Pioneer Hi-Bred International, Inc.</b>	Variety Seed Source	Variety Name or Temporary Designation PH2E4
Address (Street & No., or RFD No., City, State, Zip Code and Country) <b>7301 NW 62<sup>nd</sup> Avenue, P.O. Box 85, Johnston, Iowa 50131-0085</b>		FOR OFFICIAL USE
		PVP0 Number
Place the appropriate number that describes the varietal characters typical of this inbred variety in the spaces below. Right justify whole numbers by adding Leading zeroes if necessary. Completeness should be striven for to establish an adequate variety description. Traits designated by an '*' are considered Necessary for an adequate variety description and must be completed.		
COLOR CHOICES (Use in conjunction with Munsell color code to describe all color choices: describe #25 and #26 in Comments section):		
01=Light Green	06=Pale Yellow	11=Pink
02=Medium Green	07=Yellow	12=Light Red
03=Dark Green	08=Yellow Orange	13=Cherry Red
04=Very Dark Green	09=Salmon	14=Red
05=Green-Yellow	10=Pink-Orange	15=Red & White
		16=Pale Purple
		17=Purple
		18=Colorless
		19=White
		20=White Capped
		21=Buff
		22=Tan
		23=Brown
		24=Bronze
		25=Variegated (Describe)
		26=Other (Describe)
STANDARD INBRED CHOICES		
(Use the most similar (in background and maturity) of these to make comparisons based on <b>grow-out trial data</b> ):		
Yellow Dent Families:		
Family	Members	
B14	CM105, A632, B64, B68	
B37	B37, B76, H84	
B73	N192, A679, B73, NC268	
C103	Mo17, Va102, Va35, A682	
Oh43	A619, MS71, H99, Va26	
WF9	W64A, A554, A654, Pa91	
Yellow Dent (Unrelated):		Sweet Corn:
Co109, ND246,		C13, Iowa5125, P39, 2132
Oh7, T232,		
W117, W153R,		Popcorn:
W18BN		SG1533, 4722, HP301, HP7211
White Dent:		Pipcorn:
C166, H105, Ky228		Mo15W, Mo16W, Mo24W

Ceres/worddata/doug/96pvp

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EXHIBIT C: PH2E4

1. TYPE: (describe intermediate types in Comments section):			Standard Variety Name		
<u>2</u> 1=Sweet 2=Dent 3=Flint 4=Flour 5=Pop 6=Ornamental			<u>MO17</u>		
2. REGION WHERE DEVELOPED IN THE U.S.A.:			Standard Seed Source		
<u>5</u> 1=Northwest 2=Northcentral 3=Northeast 4=Southeast 5=Southcentral 6=Southwest 7=Other <u>NE U.S., SE U.S., SW U.S., W U.S.</u>			<u>PI 558532</u>		
3. MATURITY (In Region of Best Adaptability; show Heat Unit formula in 'Comments' section)			DAYS HEAT UNITS		
DAYS HEAT UNITS			DAYS HEAT UNITS		
<u>075</u> <u>1,448.4</u> From emergence to 50% of plants in silk			<u>076</u> <u>1,457.0</u>		
<u>074</u> <u>1,429.8</u> From emergence to 50% of plants in pollen			<u>073</u> <u>1,392.8</u>		
<u>003</u> <u>0,082.8</u> From 10% to 90% pollen shed			<u>003</u> <u>0,078.8</u>		
From 50% silk to optimum edible quality					
<u>071</u> <u>1,437.4</u> From 50% silk to harvest at 25% moisture			<u>073</u> <u>1,431.0</u>		
4. PLANT:			Standard Sample		
			Deviation Size		
<u>209.0</u> cm Plant Height (to tassel tip)			<u>230.6</u> <u>22.51</u> <u>05</u>		
<u>074.8</u> cm Ear Height (to base of top ear node)			<u>092.0</u> <u>16.54</u> <u>05</u>		
<u>016.5</u> cm Length of Top Ear Internode			<u>017.3</u> <u>01.34</u> <u>05</u>		
<u>0.0</u> Average Number of Tillers			<u>0.0</u> <u>00.01</u> <u>05</u>		
<u>1.0</u> Average Number of Ears per Stalk			<u>1.0</u> <u>00.00</u> <u>05</u>		
<u>2</u> Anthocyanin of Brace Roots: 1=Absent 2=Faint 3=Moderate 4=Dark			<u>1</u>		
5. LEAF:			Standard Sample		
			Deviation Size		
<u>09.2</u> cm Width of Ear Node Leaf			<u>09.0</u> <u>00.89</u> <u>05</u>		
<u>83.0</u> cm Length of Ear Node Leaf			<u>75.2</u> <u>09.93</u> <u>05</u>		
<u>05</u> Number of leaves above top ear			<u>06</u> <u>00.99</u> <u>05</u>		
<u>30</u> Degrees Leaf Angle (measure from 2nd leaf above ear at anthesis to stalk above leaf)			<u>33</u> <u>10.61</u> <u>05</u>		
<u>03</u> Leaf Color (Munsell code) <u>5GY34</u>			<u>03</u> <u>5GY34</u>		
<u>1</u> Leaf Sheath Pubescence (Rate on scale from 1=none to 9=like peach fuzz)			<u>1</u>		
<u>5</u> Marginal Waves (Rate on scale from 1=none to 9=many)			<u>7</u>		
<u>6</u> Longitudinal Creases (Rate on scale from 1=none to 9=many)			<u>7</u>		
6. TASSEL:			Standard Sample		
			Deviation Size		
<u>06</u> Number of Primary Lateral Branches			<u>06</u> <u>00.70</u> <u>05</u>		
<u>18</u> Branch Angle from Central Spike			<u>26</u> <u>07.52</u> <u>05</u>		
<u>61.5</u> cm Tassel Length (from top leaf collar to tassel tip)			<u>64.0</u> <u>04.47</u> <u>05</u>		
<u>6</u> Pollen Shed (rate on scale from 0=male sterile to 9=heavy shed)			<u>7</u>		
<u>07</u> Anther Color (Munsell code) <u>7.5Y8.58</u>			<u>01</u> <u>2.5GY88</u>		
<u>01</u> Glume Color (Munsell code) <u>5GY56</u>			<u>01</u> <u>5GY58</u>		
<u>1</u> Bar Glumes (Glume Bands): 1=Absent 2=Present			<u>1</u>		
Application Variety Data			Standard Variety Data		

## Application Variety Data

PH2E4

Page 2

## Standard Variety Data

7a. EAR (Unhusked Data):					
<u>11</u> Silk Color (3 days after emergence) (Munsell code)	<u>7.5R64</u>		<u>01</u>	<u>2.5GY86</u>	
<u>01</u> Fresh Husk Color (25 days after 50% silking) (Munsell code)	<u>2.5GY78</u>		<u>02</u>	<u>5GY68</u>	
<u>21</u> Dry Husk Color (65 days after 50% silking) (Munsell code)	<u>10YR92</u>		<u>21</u>	<u>2.5Y8.54</u>	
<u>3</u> Position of Ear at Dry Husk Stage: 1= Upright 2= Horizontal 3= Pendant			<u>2</u>		
<u>6</u> Husk Tightness (Rate of Scale from 1=very loose to 9=very tight)			<u>5</u>		
<u>2</u> Husk Extension (at harvest): 1=Short (ears exposed) 2=Medium (<8 cm)			<u>2</u>		
3=Long (8-10 cm beyond ear tip) 4=Very Long (>10 cm)					
7b. EAR (Husked Ear Data):					
	Standard	Sample	Standard	Sample	
	Deviation	Size	Deviation	Size	
<u>17.0</u> cm Ear Length	<u>00.00</u>	<u>05</u>	<u>18.6</u> <u>01.14</u>	<u>05</u>	
<u>41.0</u> mm Ear Diameter at mid-point	<u>02.12</u>	<u>05</u>	<u>36.6</u> <u>00.55</u>	<u>05</u>	
<u>122.8</u> gm Ear Weight	<u>19.63</u>	<u>05</u>	<u>101.6</u> <u>08.71</u>	<u>05</u>	
<u>18</u> Number of Kernel Rows	<u>00.00</u>	<u>05</u>	<u>11.0</u> <u>00.00</u>	<u>05</u>	
<u>2</u> Kernel Rows: 1=Indistinct 2=Distinct			<u>2</u>		
<u>2</u> Row Alignment: 1=Straight 2=Slightly Curved 3=Spiral			<u>1</u>		
<u>12.6</u> cm Shank Length	<u>01.67</u>	<u>05</u>	<u>12.8</u> <u>01.64</u>	<u>05</u>	
<u>2</u> Ear Taper: 1=Slight 2= Average 3=Extreme			<u>1</u>		
8. KERNEL (Dried)					
	Standard	Sample	Standard	Sample	
	Deviation	Size	Deviation	Size	
<u>10.0</u> mm Kernel Length	<u>00.71</u>	<u>05</u>	<u>10.8</u> <u>00.45</u>	<u>05</u>	
<u>07.4</u> mm Kernel Width	<u>00.55</u>	<u>05</u>	<u>08.6</u> <u>00.55</u>	<u>05</u>	
<u>04.8</u> mm Kernel Thickness	<u>00.45</u>	<u>05</u>	<u>04.8</u> <u>00.45</u>	<u>05</u>	
<u>32.4</u> % Round Kernels (Shape Grade)	<u>10.62</u>	<u>05</u>	<u>48.6</u> <u>15.01</u>	<u>05</u>	
<u>1</u> Aleurone Color Pattern: 1-Homozygous 2=Segregating			<u>1</u>		
<u>07</u> Aleurone Color (Munsell code)	<u>10YR714</u>		<u>07</u>	<u>10YR814</u>	
<u>07</u> Hard Endosperm Color (Munsell code)	<u>10YR712</u>		<u>07</u>	<u>10YR714</u>	
<u>03</u> Endosperm Type:			<u>3</u>		
1=Sweet (Su1) 2=Extra Sweet (sh2) 3=Normal Starch					
4=High Amylose Starch 5=Waxy Starch 6=High Protein					
7=High Lysine 8=Super Sweet (se) 9=High Oil					
10=Other_____					
<u>22.2</u> gm Weight per 100 Kernels (unsized sample)	<u>04.82</u>	<u>05</u>	<u>31.60</u> <u>02.07</u>	<u>05</u>	
9. COB:					
	Standard	Sample	Standard	Sample	
	Deviation	Size	Deviation	Size	
<u>23.8</u> mm Cob Diameter at mid-point	<u>00.45</u>	<u>05</u>	<u>18.6</u> <u>00.55</u>	<u>05</u>	
<u>14</u> Cob Color (Munsell code)	<u>7.5R56</u>		<u>14</u>	<u>2.5YR56</u>	

10. DISEASE RESISTANCE (Rate from 1 (most susceptible) to 9 (most resistant);  
leave blank if not tested; leave Race or Strain Options blank if polygenic):

A. Leaf Blights, Wilts, and Local Infection Diseases

	Anthracnose Leaf Blight ( <i>Colletotrichum graminicola</i> )	
	Common Rust ( <i>Puccinia sorghi</i> )	
	Common Smut ( <i>Ustilago maydis</i> )	
	Eyespot ( <i>Kabatiella zeae</i> )	
	Goss's Wilt ( <i>Clavibacter michiganense</i> spp. <i>nebraskense</i> )	
<u>3</u>	Gray Leaf Spot ( <i>Cercospora zeae-maydis</i> )	<u>4</u>
	Helminthosporium Leaf Spot ( <i>Bipolaris zeicola</i> ) Race _____	
	Northern Leaf Blight ( <i>Exserohilum turcicum</i> ) Race _____	
	Southern Leaf Blight ( <i>Bipolaris maydis</i> ) Race _____	
	Southern Rust ( <i>Puccinia polysora</i> )	
<u>8</u>	Stewart's Wilt ( <i>Erwinia stewartii</i> )	<u>7</u>
	Other (Specify) _____	

B. Systemic Diseases

Corn Lethal Necrosis (MCMV and MDMV)  
Head Smut (*Sphacelotheca reiliana*)  
Maize Chlorotic Dwarf Virus (MDV)  
Maize Chlorotic Mottle Virus (MCMV)  
Maize Dwarf Mosaic Virus (MDMV)  
Sorghum Downy Mildew of Corn (*Peronosclerospora sorghi*)  
Other (Specify) \_\_\_\_\_

C. Stalk Rots

Anthracnose Stalk Rot (*Colletotrichum graminicola*)  
Diplodia Stalk Rot (*Stenocarpella maydis*)  
Fusarium Stalk Rot (*Fusarium moniliforme*)  
Gibberella Stalk Rot (*Gibberella zeae*)  
Other (Specify) \_\_\_\_\_

D. Ear and Kernel Rots

	Aspergillus Ear and Kernel Rot ( <i>Aspergillus flavus</i> )	
	Diplodia Ear Rot ( <i>Stenocarpella maydis</i> )	
<u>6</u>	Fusarium Ear and Kernel Rot ( <i>Fusarium moniliforme</i> )	<u>6</u>
	Gibberella Ear Rot ( <i>Gibberella zeae</i> )	
	Other (Specify) _____	

## 11. INSECT RESISTANCE (Rate from 1 (most susceptible) to 9 (most resistant); (leave blank if not tested) :

	Banks grass Mite ( <i>Oligonychus pratensis</i> ) Corn Worm ( <i>Helicoverpa zea</i> ) Leaf Feeding Silk Feeding mg larval wt. Ear Damage Corn Leaf Aphid ( <i>Rhopalosiphum maidis</i> ) Corn Sap Beetle ( <i>Carpophilus dimidiatus</i> ) European Corn Borer ( <i>Ostrinia nubilalis</i> ) <u>4</u> 1st Generation (Typically Whorl Leaf Feeding) 2nd Generation (Typically Leaf Sheath-Collar Feeding) Stalk Tunneling cm tunneled/plant Fall Armyworm ( <i>Spodoptera frugiperda</i> ) Leaf Feeding Silk Feeding mg larval wt. Maize Weevil ( <i>Sitophilus zeamais</i> ) Northern Rootworm ( <i>Diabrotica barberi</i> ) Southern Rootworm ( <i>Diabrotica undecimpunctata</i> ) Southwestern Corn Borer ( <i>Diatraea grandiosella</i> ) Leaf Feeding Stalk Tunneling cm tunneled/plant Two-spotted Spider Mite ( <i>Tetranychus urticae</i> ) Western Rootworm ( <i>Diabrotica virgifera virgifera</i> ) Other (Specify) _____	<u>3</u>
12. AGRONOMIC TRAITS:		
<u>4</u>	Staygreen (at 65 days after anthesis) (Rate on a scale from 1=worst to excellent) % Dropped Ears (at 65 days after anthesis) % Pre-anthesis Brittle Snapping % Pre-anthesis Root Lodging	<u>3</u>
<u>0.0</u>	Post-anthesis Root Lodging (at 65 days after anthesis)	<u>1.2</u>
<u>5.747.1</u>	Kg/ha Yield of Inbred Per Se (at 12-13% grain moisture)	<u>3.585.7</u>

## 13. MOLECULAR MARKERS: (0=data unavailable; 1=data available but not supplied; 2=data supplied):

1 Isozymes

0 RFLP's

0 RAPD's

COMMENTS (eg. state how heat units were calculated, standard inbred seed source, and/or where data was collected. Continue in Exhibit D):

## CLARIFICATION OF DATA IN EXHIBITS B AND C

Please note the data presented in Exhibit C, "Objective Description of Variety," are collected primarily at Johnston and Ankeny, Iowa. The data in Exhibit B are from comparisons of inbreds grown in the same tests in the adapted growing area of PH2E4 and in Johnston and Ankeny, Iowa. The data in Tables 1A and 1B are from paired comparisons collected in Johnston and Ankeny, Iowa. The data in Table 2 are from paired comparisons grown primarily in the adapted growing area of PH2E4. These traits collectively show distinct differences between the two varieties.

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The data collected in exhibit C were collected in 1997 and 1998 for page 1 and 2. There are environmental factors that differ from year to year and environment to environment. The environments had different planting dates within each year. Environmental temperature and precipitation differences during the vegetative and grain fill periods can impact plant and grain traits and be a source of variability. These data are mostly based on 5 plants measured at each location. There often is more variability associated with year to year factors than from location to location or within locations. Please see Table 3 for average temperature and rainfall information in 1997 and 1998.

**Table 3. Temperature and Rainfall****TEMPERATURE**

<b>YEAR</b>	<b>MAY</b>	<b>JUN</b>	<b>JULY</b>	<b>AUG</b>	<b>AVERAGE</b>
<b>1994</b>	59.8	70.7	71.9	69.0	<b>67.9</b>
<b>1995</b>	56.2	69.4	74.3	76.9	<b>69.2</b>
<b>1996</b>	56.2	69.3	71.3	70.5	<b>66.8</b>
<b>1997</b>	53.5	70.6	74.1	69.6	<b>67.0</b>
<b>1998</b>	64.7	66.6	74.8	73.5	<b>69.9</b>
<b>1999</b>	60.7	69.7	78.7	70.5	<b>69.9</b>

**RAINFALL**

<b>YEAR</b>	<b>MAY</b>	<b>JUN</b>	<b>JULY</b>	<b>AUG</b>	<b>Total</b>
<b>1994</b>	3.67	5.75	1.71	4.18	<b>15.31</b>
<b>1995</b>	5.04	4.19	2.94	2.87	<b>15.04</b>
<b>1996</b>	8.47	4.35	2.51	2.14	<b>17.47</b>
<b>1997</b>	4.32	3.27	4.10	1.36	<b>13.05</b>
<b>1998</b>	6.46	11.07	5.70	4.96	<b>28.19</b>
<b>1999</b>	6.46	4.54	4.45	6.55	<b>21.85</b>

U.S. DEPARTMENT OF AGRICULTURE  
AGRICULTURAL MARKETING SERVICE**EXHIBIT E**  
**STATEMENT OF THE BASIS OF OWNERSHIP**

The following statements are made in accordance with the Privacy Act of 1974 (5 U. S. C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S)  <b>PIONEER HI-BRED INTERNATIONAL, INC.</b>	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME  <b>PH2E4</b>
4. ADDRESS (Street and No., or R.F.D. No., City, State, and ZIP, and Country)  <b>7301 NW 62<sup>nd</sup> AVENUE P.O.BOX 85 JOHNSTON, IA 50131-0085</b>	5. TELEPHONE (include area code)  <b>515-270-4051</b>	6. FAX (include area code)  <b>515-253-2125</b>
7. PVPO NUMBER		

8. Does the applicant own all rights to the variety? Mark an "X" in appropriate block. If no, please explain ☒ YES ☐ NO9. Is the applicant (individual or company) a U.S. national or U.S. based company? ☒ YES ☐ NO

If no, give name of country

10. Is the applicant the original owner? ☒ YES ☐ NO If no, please answer one of the following:

a. If original rights to variety were owned by individual(s), is(are) the original owner(s) a U.S. national(s)?

☐ YES ☐ NO if no, give name of country

b. If original rights to variety were owned by a company(ies), is(are) the original owner(s) a U.S. based company?

☒ YES ☐ NO If no, give name of country

11. Additional explanation on ownership (if needed, use reverse for extra space):

PH2E4 is owned by Pioneer Hi-Bred International, Inc.

**PLEASE NOTE:**

Plant variety protection can be afforded only to owners (not licensees) who meet one of the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country Which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed final breeding. See section 41(a)(2) of the Plant Variety Protection Act for definition.

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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